Science Enabling Exploration: Using LRO to Prepare for Future Missions

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Discoveries from LRO have transformed our understanding of the Moon (e. g., [1],[2],[3]), but LRO's instruments were originally designed to collect the measurements required to enable future lunar surface exploration [3]. A high lunar exploration priority is the collection of new samples and their return to Earth for comprehensive analysis [4]. The importance of sample return from South Pole-Aitken is well-established [Jolliff et al., this conference], but there are numerous other locations where sample return will yield important advances in planetary science. Using new LRO data, we have defined an achievability envelope based on the physical characteristics of successful lunar landing sites [5]. Those results were then used to define 1km x 1km regions of interest where sample return could be executed, including: the basalt flows in Oceanus Procellarum (22.1N, 53.9W), the Gruithuisen Domes (36.1N, 39.7W), the Dewar cryptomare (2.2S, 166.8E), the Aristarchus pyroclastic deposit (24.8N, 48.5W), the Sulpicius Gallus formation (19.9N, 10.3E), the Sinus Aestuum pyroclastic deposit (5.2N, 9.2W), the Compton-Belkovich volcanic complex (61.5N, 99.9E), the Ina Irregular Mare Patch (18.7N, 5.3E), and the Marius Hills volcanic complex (13.4N, 55.9W). All of these locations represent safe landing sites where sample returns are needed to advance our understanding of the evolution of the lunar interior and the timescales of lunar volcanism ([6], [7]). If LRO is still active when any future mission reaches the surface, LRO's capability to rapidly place surface activities into broader geologic context will provide operational advantages. LRO remains a unique strategic asset that continues to address the needs of future missions.

References: [1] M. S. Robinson et al., *Icarus*, 252, 229–235, 2015. [2] S. E. Braden et al. *Nat. Geosci.*, 7, 11, 787–791, 2014. [3] J. W. Keller et al. *Icarus*, 273, 2–24, 2016. [4] LEAG, Lunar Exploration Roadmap, 2011. [5] S. J. Lawrence et al., LPI Contrib. 1863, p. 2074, 2015 [6] C. K. Shearer et al., LPI Contrib. 1820, p. 3041, 2014. [7] S. J. Lawrence et al., LPI Contrib 1820, p. 3062, 2014